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Status Survey of the Peppered Shiner, Notropis perpallidus Hubbs and Black, in Arkansas and Oklahoma

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Abstract.—The peppered shiner, *Notropis perpallidus* Hubbs and Black, is a small, silvery, upland stream fish found only in southwestern Arkansas and eastern Oklahoma. This fish species was studied from 1999-2001 to determine its distribution, habitat, and conservation status. A total of 81 collections was made during the 2-year study; however, only 17 specimens were collected. The present distribution of the peppered shiner in Arkansas and Oklahoma is described as well as the conservation status of this cyprinid in both states.

Key words:—Peppered shiner, *Notropis perpallidus*, Arkansas, Oklahoma, habitat, distribution, conservation, cyprinid.

Introduction

The peppered shiner, *Notropis perpallidus* Hubbs and Black, is a slender pallid minnow that is restricted to the tributaries of the Red and Ouachita rivers in southeast Oklahoma and southern Arkansas (Snelson et al 1980). It not only occupies large clear streams and rivers of the Ouachita Mountains, but also extends onto the Coastal Plain physiographic region of Arkansas in the Saline River system (Robison and Buchanan 1988). This fish has never been common and appears to have declined over the past 30 years in both Arkansas and Oklahoma. Its conservation status is uncertain, as little data exist on which to make a formal decision as to its need for federal protection. Its current formal status is just whether it is currently protected or not. That can be known.

A 2-year survey of the peppered shiner was initiated to determine the present distribution and abundance of this cyprinid in Arkansas and Oklahoma.

The peppered shiner is a rare cyprinid fish species originally described in 1940 from only two specimens by Hubbs and Black (1940) from the Saline River (Ouachita River Drainage) 8.1 km north of Warren, Bradley County, Arkansas. Actually, this cyprinid was first collected in the Saline River (UMMZ 197684) near Benton, Arkansas, in 1884 by America's premier ichthyologist David Starr Jordan and his student, Charles Henry Gilbert, although it was misidentified as *N. dilectus*. Snelson and Jenkins (1973) later studied the systematics of this rare species, redescribed the species, and established its presently accepted name, the peppered shiner. Originally, this diminutive shiner was called the colorless shiner. Today, the lack of knowledge regarding the peppered shiner's systematic relationships and life history requirements makes it one of the most poorly known cyprinid fishes in North America.

Relatively little attention has been given to this small shiner other than notations regarding locality records or cursory descriptions of ecological requirements (Miller and Robison 1973, Wagner et al. 1987, Robison and Buchanan 1988). In independent studies both Robison (1974) and Buchanan (1974) considered the peppered shiner as "rare" in Arkansas. In Oklahoma, both Robison et al. (1974) and the Rare and Endangered Species of Oklahoma Committee (1975) had also considered this species as "rare." More recently, Warren et al. (2000) reviewed the diversity, distribution, and conservation status of all native freshwater fishes of the southern United States. The peppered shiner was listed with a status of "vulnerable."

The peppered shiner is restricted to the Ouachita and Red rivers in southeastern Oklahoma and southern Arkansas (Snelson and Jenkins 1973, Robison and Buchanan 1988, Fig. 1).

Habitat.—Robison and Buchanan (1988) reported that the peppered shiner inhabits pool regions 0.6 – 1.2 m deep in moderate-sized, warm, clear rivers. They noted this species is

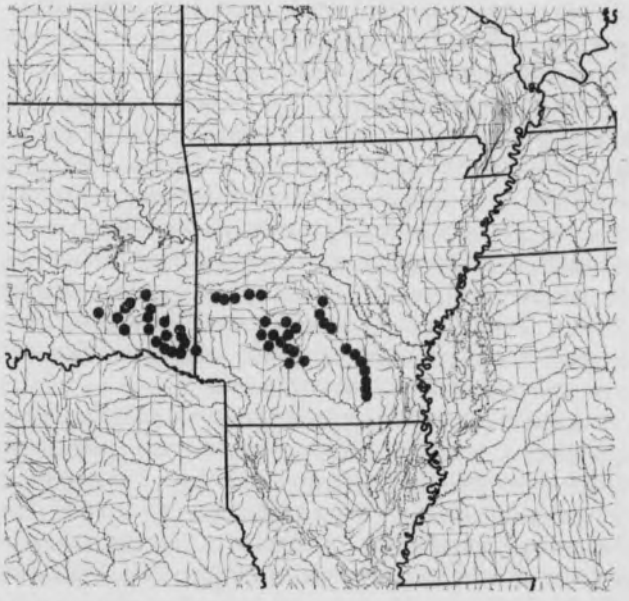

Fig. 1. Distribution of the peppered shiner, *Notropis perpallidus*, in Arkansas and Oklahoma.

rarely found in smaller streams. Typically, it occurs in the lee of islands and other obstructions away from the main current (Snelson and Jenkins 1973). Harris and Douglas (1978) reported the peppered shiner in the mainstream of the Ouachita River in water 0.6 – 1.2 m in depth with slow to moderate current. Most specimens Harris (1977) found were in habitat that included water willow (*Justicia americana*) and a rock and sand substrate. Wagner et al. (1987) found that substrate type was relatively unimportant in determining the microhabitat distribution of *N. perpallidus*, but depth and current were important. They reported that this species tends to occupy water deeper than 0.5 m (20 inches) where current speeds are less than 0.3 cm (.01 feet) per second. Page and Burr (1991) reported the peppered shiner from pools and sluggish areas of small to medium rivers, often in quiet water near vegetation. Moore (1948) collected a single specimen in a silty habitat below a dam on the Mountain Fork River in Oklahoma. In the Ouachita River drainage, it has been found both above and below the Fall Line and is often associated with beds of *Justicia americana* over a variety of habitats.

Species Associates.—The peppered shiner is commonly found in association with the bigeye shiner (*Notropis boops*), carmine shiner (*Notropis percobromus*), steelcolor shiner (*Cyprinella whipplei*), longear sunfish (*Lepomis megalotis*), blackspotted topminnow (*Fundulus olivaceus*), brook silverside (*Labidesthes sicculus*), northern hog sucker (*Hypentelium nigricans*), smallmouth bass (*Micropterus dolomieu*), and greenside darter (*Ethesotoma blennioides*).

Materials and Methods

Field work was conducted from September 1999 to November 2001. Eighty-one collections of fishes were made in Arkansas and Oklahoma during this status survey.

Fishes were collected using standard common sense minnow seines varying in length from 4.6-6 meters and 1.8 meters in height with a bar mesh of either 0.3 or 0.6 cm. Fishes were preserved in 10 % formalin in the field and later transferred to 50 % isopropyl alcohol for permanent storage. Representative specimens of the peppered shiner were preserved from some sites and returned to the laboratory at Southern Arkansas University for further analysis. Associated fishes collected were also transported back to the laboratory where identifications of all species and counts of each were made.

In addition, all known contemporary and historical literature regarding the peppered shiner was reviewed and relevant findings summarized or referenced herein. Data were used from museum collections/known localities of peppered shiners collected in Arkansas and Oklahoma. Coverage includes the University of Michigan Museum of Zoology (UMMZ), Tulane University (TU), the University of Louisiana at Monroe (NLU), Arkansas State University Museum of Zoology (ASUMZ), the University of Arkansas (UA), Oklahoma State University (OSU) and the University of Oklahoma (OU).

Results and Discussion

Habitat.—In this study the peppered shiner was found just off concentrations of water willow beds and to the side of riffles or islands where the current is stronger. There is some indication that juvenile individuals utilize these beds as safe havens. Individuals seem to occupy areas of the stream away from the current in the lee of islands as reported earlier by Snelson and Jenkins (1973). Substrates where specimens were collected ranged from sandy areas and areas with gravel to some larger rocky areas. All specimens were collected from deep water and never in the shallow reaches of moderate-sized river sections. No specimens were taken from side tributaries of main rivers even though seining was done in side tributaries to see if perhaps the peppered shiner retreated into those regions.

This study shows the peppered shiner to be a midwater schooling species that prefers stream sections of clear, upland and lowland, medium to large rivers. It usually occurs over gravel or sand bottoms away from the current. The peppered shiner seems to have an affinity for aquatic vegetation such as *Justicia americana*, which is common within its range.

Distribution.—The peppered shiner is restricted to the tributaries of the Red and Ouachita rivers in southeast Oklahoma and southern Arkansas (Miller and Robison 1973, Snelson and Jenkins 1973, Snelson et al. 1980, Robison and Buchanan 1988, Fig. 1). The following is a presentation of the distribution of the peppered shiner by river system or main river area. Comments are made concerning its historical presence, plus the findings of this survey.

Ouachita River Mainstem, Arkansas.—Harris (1977) collected 74 specimens of the peppered shiner from 4 localities in the upper Ouachita River mainstem. The four localities were (1) Polk County: Ouachita River at McGuire Public Access, approximately 2.4 km (1.5 mi) south of St. Hwy. 88 (Sec. 23, T2S, R29W); (2) Ouachita River and Mill Creek at bridge, 1.1 km (0.7 mi) south of Cherry Hill (Sec. 9, T2S, R28W); (3) Montgomery County: Ouachita River at U. S. Hwy. 270 bridge at Rocky Shoals Recreation Area (Sec. 32, T1S, R25W); and (4) Ouachita River at Chasewood Landing, approximately 1.6 km (1 mi) east of St. Hwy. 298 (Sec. 28, T1S, R25W). In a subsequent study of the fishes of the upper Ouachita River, Herrock (1986) did not collect a single specimen of the peppered shiner in his survey of 31 stations during 1985-1986.

In this study, only 6 specimens of the peppered shiner were collected from the upper Ouachita River mainstem from only 2 localities of the 15 sampled (Table 1). The 2 localities were (1) Polk County: Ouachita River at McQuire Access Area, 2.4 km (1.5 mi) south of St. Hwy. 88 (Sec. 23, T2S, R29W) and (2) Polk County; Ouachita River, 1.1 km (0.7 mi) south of Cherry Hil

able 1. Collecting localities, numbers of collections, and numbers of peppered shiners collected in Arkansas in 1999-2001.

Locality (River System)	No. of Collections	No. Sites w/Peppered Shiners/No. Collected
1. Ouachita River (mainstem)	15	2/6
2. Caddo River	10	0/0
3. Little Missouri River	11	0/0
4. Saline River	15	3/11
5. Kiamichi River	15	0/0
6. Mountain Fork River	10	0/0
TOTAL	76	5/17

(Sec. 9, T2S, R28W).

Raymond (1975) surveyed the lower Ouachita River below Remmel Dam to the AR/LA state line. He collected 42,246 specimens distributed among 111 species in 62 collections from 25 locations. In all these collections, only a single specimen of the peppered shiner was taken from the Ouachita River at the mouth of the Little Missouri River north of Chidester, AR.

Caddo River System, Arkansas.—Fruge (1971) originally surveyed the fishes of the Caddo River and reported 62 specimens of the peppered shiner out of 37,273 individual fishes collected at 4 different localities. The 4 localities were (1) Clark County: Caddo River at St. Hwy. 182, 2.7 km (1.7 mi) north of Amity (Sec. 22, T5S, R23W); (2) Caddo River, approximately 0.5 km (1/3 mi) below DeGray Dam (Sec. 14 and 23, T6S, R20W); (3) Caddo River just below control dam spillway, approximately 3.2 km (2 mi) west of Caddo Valley (Sec. 35 and 36, T6S, R20W); and (4) Caddo River at Chasewood Landing, approximately 1.6 km (1 mi) east of St. Hwy. 298 (Sec. 28, T1S, R25W). Five additional specimens of the peppered shiner were taken by NLU students from below the DeGray Lake dam in 1972. Lisa Herrock (1986) did not collect a single specimen of the peppered shiner in her subsequent 1985-1986 survey of the fishes of the Caddo River, although she collected 37,109 individual fish specimens in 67 collections from 21 localities.

In this study no specimens of the peppered shiner were taken in 10 collections made from the Caddo River system (Table 1).

Little Missouri River System, Arkansas.—Myers (1977) irst surveyed the fishes of the Little Missouri River from 1976-977 and reported 21 specimens of the peppered shiner from 3 ifferent locations out of 58 collections from 20 localities and total of 23,852 individual fishes. The 3 localities where the eppered shiner was collected were (1) Pike County: Antoine iver at St. Hwy. 26; (2) Little Missouri River at end of gravel ad (Sec. 3, T11S, R18W); (3) Little Missouri River at the nction with the Ouachita River (Sec. 1, T11S, R18W).

Later, Loe (1983) re-surveyed the Little Missouri River system from 1980-1983 and did not collect the peppered shiner even though he collected 25,039 fishes in 57 collections from 35 localities. Ponder (1983) surveyed the Terre Noire Creek, a large tributary of the Little Missouri River, and reported 87 specimens of the peppered shiner from 6 localities in a boat ditch.

In the present study not a single specimen of the peppered shiner was taken from the Little Missouri River system even though 11 collections were made from 10 localities in the system (Table 1).

Saline River System, Arkansas.—Hubbs and Black (1940) described the peppered shiner from only two specimens collected 8 km (5 mi) north of Warren, Bradley County, Arkansas. Reynolds (1971) first surveyed the fishes of the Saline River system, a Ouachita River tributary and collected only 23 specimens of the peppered shiner from 5 localities. The 5 localities in the Saline River system were: (1) Saline County: Saline River, 3.2 km (2 mi) east of St. Hwy. 67 on county road (Sec. 21, T2S, R15W); (2) Grant County: Saline River at St. Hwy. 229 (Sec. 4, T4S, R15W); (3) Saline River at St. Hwy 46, 4 km (2.5 mi) NE of Leola, AR (Sec. 8, T6S, R14W); (4) Drew County: Saline River at end of St. Hwy. 172 (Sec. 14, T14S, R9W); (5) Bradley County: Saline River at St. Hwy 4, 4.8 km (3 mi) east of Warren, AR (Sec. 3, T12S, R9W). The 23 specimens of peppered shiners were out of 36,719 individual fishes taken in 62 collections from 32 total localities throughout the river system.

In a subsequent re-survey of the Saline River system in 1981-1982, Stackhouse (1982) collected 65 specimens of the peppered shiner from 10 different localities. The 10 localities in the Saline River system were (1) Grant County: Saline River at St. Hwy 229, 0.8 km (0.5 mi) south of Saline County line (Sec 4, T4S, R14W); (2) Saline River at U.S. Hwy 270, 0.8 km (0.5 mi) west of Prattville (Sec 10, T5S, R15W); (3) Saline River at St. Hwy 46, 4 km (2.5 mi) NE of Leola, AR (Sec. 8, T6W, R14W); (4) Saline River at gravel road, 6.4 km (4 mi) SW of Herbine (Sec. 6, T10S, R9W); (5) Bradley County: Saline River at St. Hwy 15, 8 km (5 mi) north of Warren (Sec 3, T12S, R9W);

(6) Saline River at St. Hwy 4, 4.8 km (3 mi) east of Warren (Sec. 3, T12S, R9W); (7) Saline River, 3.2 km (2 mi) downstream from St. Hwy. 4 (Sec. 10, T13S, R9W); (8) Saline River at end of county road south of St. Hwy 4 (Sec 15, T13S, R9W); (9) Saline River, 1.6 km (1 mi) east of St. Hwy 189 on gravel road 11.2 km (7 mi) north of Johnsville (Sec. 26, T14S, R9W); and (10) Saline River at end of county road, 9.6 km (6 mi) south of Johnsville (Sec. 26, T16S, R9W). Stackhouse (1982) took 27,836 individual fish specimens in 115 collections from 50 different localities throughout the Saline River system.

In this survey, 11 specimens of the peppered shiner were taken in 15 collections from the Saline River system during 1999-2001 (Table 1). Collections made from 1999-2001 from the Saline River by HWR re-established the peppered shiner as a widespread, although rare fish species in the Saline River. The peppered shiner was found at 3 localities in the system during the present study: (1) Grant County: Saline River at St. Hwy. 229; (2) Drew County: Saline River at end of St. Hwy. 172; and (3) Bradley County: Saline River at end of county road, 9.6 km (6 mi) south of Johnsville. A total of 11 specimens was collected from the Saline River during this most recent survey (Table 1).

Kiamichi River System, Oklahoma.—Pigg and Hill (1974) surveyed the fishes of the Kiamichi River system from 1972-1973 and included 141 sampling stations. In addition, data from other ichthyologists were also used in the study. These collections were made prior to the construction of the Hugo Reservoir on the Kiamichi River. Echelle and Schnell (1976) performed a factor analysis of species associations among fishes of the Kiamichi River, but did not include the peppered shiner in their factor analysis. They did mention that *N. perpallidus* was uncommon and found at only 4 localities.

In this survey, 15 collections were made in the upper Kiamichi River system; however, no specimens of the peppered shiner were taken (Table 1).

Mountain Fork River System, Arkansas and Oklahoma.—George A. Moore, noted ichthyologist from Oklahoma State University, collected the first specimen of the peppered shiner from Oklahoma from the Mountain Fork River below a dam on the river in Beaver's Bend State park (Moore 1973) on 6 June 1947. He was able to collect only a single specimen (Moore 1948).

Reeves (1953) collected 25 specimens from the entire Little River system for his doctoral dissertation. Later, Finnell et al. (1956) reported specimens from 2 localities in their survey of the fishery resources of the Little River system. The 2 localities were (1) Cutoff pool near Mountain Fork mouth (Sec 10, T7S, R26E) and (2) Mountain Fork River near the mouth (Sec. 10, T7S, R26E). The peppered shiner was reported to comprise 0.3 % of the 2,097 specimens collected in the lower reaches of the Mountain Fork River drainage.

Wagner et al. (1987) reported the last collection of the peppered shiner in the Mountain Fork River system in 196', before impoundment of the Broken Bow Reservoir in 196. Historically, the peppered shiner has never been taken abov the existing reservoir.

No specimens of the peppered shiner were collected in the Mountain Fork River in the current survey although 10 collections were made in the upper river system (Table 1).

Other Oklahoma Areas Inhabited.—In addition to the river systems discussed above which were all sampled during the present survey, the peppered shiner has been taken from the Glover River (Wagner, et al. 1987) in Oklahoma. The Glover River is part of the Little River drainage. Previously, Taylor and Wade (1972) had not collected the peppered shiner in their pre-impoundment survey of the Glover River.

A single collection of 3 specimens of the peppered shiner was made from McGee Creek, a small upland stream with large pools and very small riffles in the Muddy Boggy River system, located near Lane, Atoka County, Oklahoma by Pigg (1977). The distribution of the peppered shiner was thus extended west of the Kiamichi River system in Oklahoma to the Muddy Boggy River system.

Historic Conservation Status.—The state of Arkansas presently has no official state list of threatened or endangered wildlife or plants. Instead, protection is afforded primarily to federally threatened species by the Arkansas Game and Fish Commission.

Both Buchanan (1974) and Robison (1974) in independent assessments of the threatened fishes of Arkansas included the peppered shiner in their publications. Buchanan (1974) gave the peppered shiner a status of rare as did Robison (1974). Robison and Buchanan (1988) listed *Notropis perpallidus* as "threatened" in their discussion of rare and endangered fishes in Arkansas.

In Oklahoma, Robison et al. (1974) listed the peppered shiner as "rare" with little comment. The Rare and Endangered Species of Oklahoma Committee (1975) pronounced the peppered shiner "rare' in Oklahoma with a "Rare-2" status, which meant the species may be quite abundant where it occurs, but is known from only a few localities or in a restricted habita within Oklahoma.

Habitat loss is one of the greatest causes of the declines i populations of native fishes in North America (Williams et al 1989). Widespread reservoir construction and declines in wate quality have severely altered most of North America's clean free-flowing riverine habitat (Benke 1990). In their review of th tolerances and degradation in water quality and habitat, Jester e al. (1992) considered the peppered shiner as "Intolerant."

Recently, the Southeastern Fishes Council Technica Advisory Committee (SFCTA), consisting of 12 ichthyologist from throughout the South reviewed the diversity, distribution and conservation status of the freshwater fishes of the southern United States, which includes over 600 species of fishes. In th resulting publication, Warren et al. (2000) listed the pepperec

ner as "Vulnerable" where vulnerable meant "a species or ›species that may become endangered or threatened by atively minor disturbances to its habitat or that deserve careful ›nitoring of its distribution and abundance in the continental ters of the United States."

Warren et al. (2000) found that 28 percent of the total fish una of over 600 species in the southern United States (which included both Arkansas and eastern Oklahoma) is jeopardized to some extent, of which 6% are endangered, 7% are threatened, and 15% are regarded as vulnerable. The SFCTA Committee reports that this represents a 75% increase since 1989 in jeopardized southern fishes and an incredible 125% increase in the past 20 years. Disappointingly, the trend for fishes in the southern United States is clear; jeopardized fishes are successively being moved from the vulnerable category to that of imminent threat of extinction (Warren et al. 2000).

Conclusions

Present Conservation Status.—Eighty-one collections of fishes were made during this study within the historical distribution of the peppered shiner in Arkansas and Oklahoma in an attempt to document the present conservation status of the peppered shiner. From these 81 collections in Oklahoma and Arkansas, only 17 specimens of peppered shiners were captured, all in Arkansas (Table 1). No specimens of the peppered shiner were collected in Oklahoma. After careful review of all of the major museum holdings of the peppered shiner available, 2 years of intensive field work collecting peppered shiners, review of all pertinent literature, and discussions with virtually all of the major collectors of peppered shiners in Arkansas, it is apparent that the peppered shiner has declined in abundance throughout its historical range in Arkansas.

Table 2 provides a quick view of the decline in abundance of the peppered shiner in Arkansas and Oklahoma by decade. While certainly not definitive, Table 2 shows the peppered shiner seeming to decline in the decade of the 1980s and continuing into the 1990s to the present study. The large number of peppered shiners collected by workers in the 1970s is illustrative of the "golden decade" of ichthyological collecting in both Arkansas and Oklahoma as hundreds of collections of fishes were made. Many of these collections of fishes were made as part of a variety of Master's theses on numerous Arkansas River systems by graduate students (e.g. Fruge 1971, Harris 1977, J. E. Herrock 1986, L. W. Herrock 1986) and Jimmie Pigg's 1977 collections in Oklahoma.

A closer inspection of the 791 museum specimens of the eppered shiner grouped by river system reveals that 40.96 % 324 individuals) of the specimens were collected from a single ver, the Little River (Table 3). The next most abundant river ystem in producing peppered shiner was the Saline River ystem (15.80 %), followed by the Little Missouri River system 3.65 %) and the upper Ouachita River (10.62%). The Kiamichi River produced the fewest number of specimens (3.29 %) (Table 3).

Table 2. Number of peppered shiners collected by year.

Years	No. Peppered Shiners
1940-1949	5
1950-1959	31
1960-1969	36
1970-1979	346
1980-1989	92
1990-1999	18
2000-2001	17
Totals	545

Overall there seems to be a decline in the populations of the peppered shiner in both Arkansas and Oklahoma based on the data gathered from this study. This apparent overall reduction in range and abundance in Arkansas and Oklahoma necessitates a re-evaluation of the conservation status of the peppered shiner.

Reasons for this decline seem to be multiple and complex. Destruction and modification of habitat from impoundments with concomitant cold water release may be a part of the problem for the peppered shiner. The peppered shiner has disappeared from the lower Caddo, which was impounded as DeGray Lake. Northeast Louisiana University students collected peppered shiners from the Caddo River below the dam in the 1970's prior to the closure of the dam on DeGray Lake. The peppered shiner has never been collected since then in the Caddo River system. Cold water releases impacts areas many kilometers downstream from reservoirs. Reservoirs also effectively eliminate migration by obligate stream fishes from one tributary to another, precluding natural colonization of potential suitable streams. Increases in turbidity and siltation have also occurred in the upland streams inhabited by the peppered shiner as poor land practices such as road building, farming, clearing of land for pasture, clearcutting, destruction of riparian buffer strips and other human perturbations continue in these watersheds. Other possible reasons for decline of the peppered shiner include gravel removal operations in a number of Arkansas streams (Filipek and Oliver 1994) and nutrient enrichment from the enormous increase in poultry and swine operations and human population increases.

One factor that figures into the conservation status of the peppered shiner is the possibility that this cyprinid species may have never been abundant, even in earlier years (see Table 2). Note that from 1940-1969, only 72 specimens of the peppered shiner were collected despite the work of a number of eminent active ichthyologists like G. A. Moore (OSU), C. L. Hubbs and John Black (University of Michigan), and others.

During these 2 years HWR was able to document the continued presence of the peppered shiner in only 2 of the river

Table 3. Collections of the peppered shiner by river system.

River System	No. Peppered Shiners	Percentage of Total Peppered Shiners	Collections
Ouachita River	84	10.62	151
Caddo River	62	7.84	141
Little Missouri River	108	13.65	126
Saline River	125	15.80	192
Little River	324	40.96	37
Glover River	33	4.17	7
Mountain Fork River	29	3.67	15
Kiamichi River	26	3.29	76
Total	791	100.0	745

systems in Arkansas from which it was collected historically; the Ouachita mainstem and the Saline River systems (Table 1). No specimens of the peppered shiner were collected from the Little Missouri River, Caddo River, Kiamichi River, Mountain Fork River, or Glover River, although 52 collections were made in those river systems.

Status Recommendation.—Thus, after carefully reviewing the collection records of the peppered shiner from the University of Louisiana at Monroe, the University of Oklahoma, Oklahoma State University, Tulane University, Arkansas State University, and 2 years of field work, the peppered shiner is not herein recommended for official federally threatened status at this time. Rather, this small, cyprinid species should be accorded a status of "Vulnerable" as used by Warren et al. (2000) and a program be initiated to monitor its continued existence. Small population size and low densities make it imperative that a careful watch be maintained on this species in the future.

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